CLAIMS

1. A spindle motor comprising:

a) a baseplate;

b) a shaft supported by said baseplate;

c) a stator assembly comprising

i) a core having poles and

ii) windings around said poles;

iii) the stator core being rigidly attached to said baseplate;

d) injection molded thermoplastic material encapsulating said windings, and

e) a hub supported on said shaft, said hub having a magnet connected thereto in operable proximity to the stator assembly.

2. The spindle motor of claim wherein thermoplastic is in an intimate contact with the baseplate.

3. The spindle motor of claim 1 wherein the baseplate is made of aluminum.

4. The spindle motor of claim 1 wherein the stator assembly is rigidly attached to the baseplate by being rigidly attached to a support member secured to said baseplate.

5. The spindle motor of claim 4 wherein the thermoplastic encapsulating the windings is adhered to said support member and said baseplate.

6. The spindle motor of claim 1 wherein the thermoplastic used in the encapsulation has a vibratory dampening ratio of at least 0.05 in the range of 0-500 H_z and a modulas of elasticity of at least 1,000,000 psi at 25°C.

7. The spindle motor of claim 1 wherein the thermoplastic also encapsulates the stator core except where it is rigidly attached to the baseplate.

8. The spindle motor of claim 1 wherein the hub is rotatably supported on said shaft by ball bearings interposed between the hub and the shaft.

9. The spindle motor of claim 1 wherein the thermoplastic material provides a heat sink and heat conductive path from the stator assembly to the baseplate.

10. A spindle motor comprising:

a) a baseplate;

b) a shaft supported by said baseplate;

c) a stator assembly comprising

i) a core having poles and

ii) windings around said poles,

the stator assembly being spaced from the baseplate;

d) a hub supported on said shaft, said hub having a magnet connected thereto in operable proximity to the stator assembly; and

e) a thermoplastic material secured to the baseplate and encapsulating the stator windings, the thermoplastic material joining the stator assembly to the baseplate in the space between the stator assembly and the baseplate.

11. The spindle motor of claim 10 wherein the baseplate has a plurality of holes through it and the thermoplastic material is secured to the baseplate by filing in said holes.

12. The spindle motor of claim 11 wherein the holes are enlarged on the side of the baseplate opposite to the stator assembly in order to lock the thermoplastic to the baseplate.

13. The spindle motor of claim 10 wherein the magnet is located inside of the stator assembly.

14. The spindle motor of claim 10 wherein the hub comprises an outer member having an inside aperture and a ferrule fixed inside said aperture.

15. The spindle motor of claim 14 wherein the magnet is attached to the ferrule.

16. The spindle motor of claim 14 wherein bearings are interposed between the shaft and the ferrule.

17. The spindle motor of claim 14 wherein the hub outer member is comprised of aluminum and the ferrule is comprised of steel.

18. The spindle motor of claim 10 wherein the core comprises steel laminations.

19. The spindle motor of claim 10 wherein the hub comprises a hard drive disc support member.

20. The spindle motor of claim 10 wherein the thermoplastic material includes ceramic particles.

21. The spindle motor of claim 10 wherein the thermoplastic material has a coefficient of linear thermal expansion of less than 2×10^{-5} in/in/°F throughout the range of 0-250°F.

22. The spindle motor of claim 10 wherein the thermoplastic material has a thermal conductivity of at least 0.7 watts/meter °K at 23°C.

23. The spindle motor of claim 10 wherein the thermoplastic material has a dielectric strength for at least 250 volts/mil.

24. The spindle motor of claim 10 wherein the thermoplastic material has a vibration dampening ratio of at least 0.05 in a frequency range of 0-500 Hz and a modulas of elasticity of at least 1,000,000 psi.

25. A baseplate and stator combination comprising:

a) a baseplate;

b) a stator assembly comprising

i) a core having poles, and

ii) windings around said poles; and

c) an injection molded thermoplastic material encapsulating the windings and also locking the stator assembly to the baseplate, the baseplate and stator assembly not being in direct contact with one another but rather having a space between them filled in by the thermoplastic material.

26. The baseplate and stator combination of claim 25 wherein the baseplate is made of a thermoplastic material having a modulas of elasticity of at least 1,000,000 psi and a metal plate, the metal plate being substantially encapsulated in the thermoplastic material.

27. The baseplate and stator combination of claim 26 wherein the thermoplastic material of which the baseplate is made is the same material that encapsulates the windings, and the baseplate and winding encapsulation are formed as one monolithic body.

28. The spindle motor of claim 10 wherein the baseplate comprises a stiff thermoplastic material, having a modulas of elasticity of at least 1,000,000 psi, and a metal plate substantially encapsulated in the stiff thermoplastic material.

29. The spindle motor of claim 28 wherein the stiff thermoplastic material is the same material as is used to encapsulate the windings.

30. A spindle motor comprising:

a) a baseplate made of stiff thermoplastic material, having a modulas of elasticity of at least 1,000,000 psi at 25°C, and a metal plate substantially encapsulated by the stiff thermoplastic material;

b) a shaft supported by said baseplate;

c) a stator assembly comprising

i) a core having poles and

ii) windings around said poles;

d) a hub supported on said shaft, said hub having a magnet connected thereto in operable proximity to the stator assembly; and

e) a vibration dampening thermoplastic material encapsulating the stator windings, the vibration dampening thermoplastic material having a vibration dampening ratio of at least 0.05 in the range of 0-500 Hz and joining the stator assembly to the baseplate.

31. The spindle motor of claim 30 wherein the stiff thermoplastic material is the same material as the vibration dampening thermoplastic material.

32. The spindle motor of claim 30 wherein the vibration dampening material has a vibration dampening ratio of at least 0.1 in the range of 0-500 Hz.

33. The spindle motor of claim 30 wherein the vibration dampening thermoplastic material has a vibration dampening ratio of at least 0.3 in the range of 0-500 Hz.

34. The spindle motor of claim 30 wherein the vibration dampening thermoplastic material has a vibration-dampening ratio of at least 0.5 in the range of 0-500 Hz.

35. The spindle motor of claim 30 wherein the stiff thermoplastic material has a modulas of elasticity of at least 2,000,000 psi at 25°C.

36. The spindle motor of claim 30 wherein the stiff thermoplastic material has a modulas of elasticity of at least 3,000,000 psi at 25°C.

37. The spindle motor of claim 30 wherein the hub is rotatably supported on the shaft and the shaft is rigidly attached to the baseplate.

38. A method of manufacturing a spindle motor comprising the steps of:

a) providing a baseplate, a hub having a magnet connected thereto and a stator assembly comprising a core having poles and windings around said poles;

b) rigidly attaching the stator core to the baseplate;

c) injection molding a thermoplastic material to encapsulate the windings after the core is attached to the baseplate, and

d) mounting the hub on a shaft supported on the baseplate so that the magnet on the hub is in operable proximity to the stator assembly and so that the hub can rotate with respect to the stator.

39. The method of claim 38 wherein the injection molding operation injects thermoplastic material to fill in a space between the windings and the baseplate so that the thermoplastic material is in intimate contact with the baseplate and is thereby secured thereto.

40. The method of claim 38 wherein the stator assembly is rigidly attached to the baseplate by being rigidly attached to a support member secured to the baseplate.

41. The method of claim 40 wherein the thermoplastic material encapsulating the windings is injected so as to contact the baseplate and support member.

42. The method of claim 38 wherein the thermoplastic material also encapsulates the stator core except where it is rigidly attached to the baseplate.

43. The method of claim 38 wherein the hub is rotatably supported on the shaft by ball bearings interposed between the hub and the shaft.

44. A method of manufacturing a spindle motor comprising the steps of:

a) providing a baseplate, a stator assembly comprising a core having poles and windings around said poles, and a hub having a magnet connected thereto;

b) injection molding a thermoplastic material to encapsulate the windings and in between the baseplate and stator assembly so as to secure the stator assembly to the baseplate sufficiently to allow the rigidity of the core to help stiffen the baseplate, and

c) rotatably mounting the hub on a shaft rigidly supported on the baseplate so that the magnet on the hub is in operable proximity to the stator assembly.

45. The method of claim 44 wherein the baseplate has a plurality of holes in it and the thermoplastic material is injected so as to fill in said holes.

46. The method of claim 45 wherein the holes are enlarged on the side of the baseplate opposite to the stator assembly and the thermoplastic is thus locked to the baseplate by solidifying in the enlarged hole areas.

47. A method of manufacturing a spindle motor comprising the steps of:

a) providing a metal baseplate insert, a hub having a magnet connected thereto and a stator assembly comprising a core having poles and windings around said poles;

b) holding the baseplate insert and stator assembly in an injection mold and injection molding a thermoplastic material so as to substantially encapsulate the baseplate insert and the windings and secure the stator assembly and baseplate insert together; and

c) rotatably mounting the hub on a shaft rigidly supported on the combined encapsulated baseplate insert and stator assembly so that the magnet on the hub is in operable proximity to the stator assembly.

48. The method of claim 47 wherein the shaft is also held in the injection mold and the thermoplastic material contacts the shaft so as to secure the shaft in rigid support with the combined encapsulated baseplate insert and stator assembly.

49. A spindle motor comprising:

a) a baseplate;

b) a shaft supported by said baseplate;

c) a coreless stator assembly comprising windings encapsulated in a thermoplastic material; and

d) a hub rotatably supported on said shaft, said shaft having a magnet connected thereto in operable proximity to the stator assembly, the hub also including a flux return ring supported opposite the magnet so that the stator assembly is located between the flux return ring and the magnet.

50. The spindle motor of claim 49 wherein the flux return ring comprises a piece of machined steel and the hub comprises an outer member having an inside aperture and a ferrule fixed inside said aperture.

51. The spindle motor of claim 50 wherein the magnet is attached to the ferrule and the ferrule also acts as a flux return ring.

52. The spindle motor of claim 1 wherein the shaft is rotatably supported by the baseplate and the hub is rigidly attached to the shaft.

53. The spindle motor of claim 10 wherein the magnet is adjacent an inside diameter of the stator.

54. A hard drive including the motor of claim 1.

55. The hard drive of claim 54 wherein the baseplate of the motor also constitutes the baseplate of the hard drive housing.

56. A hard drive including the motor of claim 10.

57. A hard drive including the motor of claim 30.